FOREST PEST MANAGEMENT

3430 BIOLOGICAL EVALUATION
R2-83-6

Mountain Pine Beetle in
Grand County Colorado
1983

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Forest Pest Management
Denver, Colorado

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HISTORY OF MOUNTAIN PINE BEETLE IN GRAND COUNTY*

Our first recorded incidence of MPB in Grand County dates from 1932 when a stand of infested limber pine on State land was discovered in the Beaver Creek watershed. At that time the infestation was increasing, favored presumably by recent dry weather. Searches of adjacent lodgepole pine stands did not result in locating any infested trees in this type. However, in 1934 mountain pine beetle populations invaded the lodgepole stands. Treatment was by fell and burn or fell and peel. These operations were conducted until 1939 when the population subsided. Treatment was conducted in the following areas: Potato Hill - Hot Sulphur Springs; Crown Ridge, Supply Creek, Coulter Divide, Williams Fork, Green Ridge, and Timber Creek. Some areas besides Hot Sulphur Springs were treated 3 times.

In 1947, populations increased again in limber pine on private land near Windy Gap. Scattered attacks were detected in the lodgepole type on the old Troublesome Ranger District. No control work was done except or private land where the owner logged out his infested material. The outbreak subsided and apparently little beetle activity occurred until recently.

Mountain pine beetle populations began increasing again in 1968 just south of Hot Sulphur Springs. Salvage logging was initiated, however, these efforts were not adequate to suppress populations. Buildup ratios averaged 2 to 1. Accelerated harvesting was initiated principally on BLM lands through the Beetle Abatement Management Program (BAMP). Clearcutting and partial cutting were the primary tools. The most severe infestations were on Cottonwood Pass, Beaver Creek and Willow Creek. By 1975 accelerated harvesting and beetle collapse began to merge. In 1976 only 13 sample trees could be located in the Spring Creek drainage west of Cottonwood Pass and on Behler Creek east of Elk Dale. Populations remained low for a few years.

More recently, the population trend in Grand County has been as follows:

Year	No. of Infested Trees	No. of Infested Acres	Average Infested Trees/Acre
1980	2,410	1,596	1.5
1981	8,055	9,974	0.8
1982	51,430	12,929	4.0
1983	17,165	15,367	1.1

* Information from the Regional Annual Reports and Biological Evaluations of Insect and Disease Conditions 1928-1983 on file in the Rocky Mountain Regional Office.

For comparison purposes, the number of infested trees per acre aerially detected in 1983 (Figure 1) on the Dillon Ranger District (south of Grand County) averages 6.1 and to the west of Grand County 2.7. Typically during the peak years of an outbreak the loss level within a stand will approach 20-30 trees per acre.

METHODS

Discussions were held with National Forest, Bureau of Land Management, and Colorado State Forest Service personnel to determine those areas of greatest concern within Grand County. Variable plot (10 BAF) surveys were conducted on selected areas to determine risk and population buildup ratios. In other areas, resource data supplied by the CSFS was used for the calculation of risk. In addition other areas not surveyed by the entomologists on BLM and National Forest land have recently been inventoried and a risk determination made as part of the Stage II inventory process.

The acreage of lodgepole pine type and size class was estimated from resource inventories and type maps provided by the CSFS, BLM, the Routt and Arapaho/ Roosevelt National Forests. No attempt was made to determine the lodgepole pine type and size class on the Grand County portions of Rocky Mountain National Park. Only about 12 sections of land within the Park fall within an elevation range that can is considered moderate to high risk to MPB loss.

Data used in the analysis were stand age, elevation, lodgepole basal area, mean tree diameter, percent plots infested with dwarf mistletoe, total basal area, and presence or absence of MPB. Buildup ratios were calculated from infested plot data and areas between plots where infested groups were encountered and is expressed as the ratio of 1983 attacked to 1982 attacked trees.

RESULTS

A review of the known lodgepole pine inventory for all ownerships shows the following distribution:

Lodgepole Pine Resource (Acres) by Ownership and Size Class

Ownership	Non-Stocked	Seedling/ Sapling	Pole (5-10.9")	Sawtimber (11.0+")
Routt NF	86	16,353	77,817	38,438
A/R NF	1,061	44,359	34,021	81,373
BLM	not determined	not determined	13,525	16,700
S&P	not determined	6,700	50,500	6,700
			175,863	143,210

Based on elevation and stand mapping we estimate that the following acreages by ownership are moderate or high risk to mountain pine beetle; NFS lands - 98,385; USDI lands - 30,225 and State and private lands - 57,200. Aerial sketch mapping shows that 20,108 acres on NFS lands, 19,862 acres on USDI lands and 28,383 acres on State and private lands are currently infested. An estimated 11.8 MMBF of lodgepole pine is currently infested. Figure 1 displays the known distribution of lodgepole pine and MPB in Grand County.

Table 1 displays the risk rating and average stand conditions of each area. Basal area of lodgepole ranges from 58 $\pm$ 19 (Chenoweth Ranch) to 138 $\pm$ 38 at the Sugarloaf and Tabernash Campgrounds. Mountain pine beetle is active in nine of the 15 areas surveyed. Dwarf mistletoe was found in all but 5 of the areas. Only one area, YMCA, had a low risk to mountain pine beetle. The overall buildup ratio in the survey area is 2.5 new mountain pine beetle infested trees for each old infested tree.

DISCUSSION

The predictions of stand susceptibility or risk are discussed by Amman et al 1977. In this analysis no attempt was made to determine stand boundaries in the areas surveyed. This may affect the precision with which risk can be determined. Adjacent stand conditions and population potential no doubt influence within stand results. In all cases the risk analysis reflects the expected loss; low = less than 25% mortality; moderate = 25-50% mortality and high = greater than 50% mortality. Loss refers to lodgepole stems larger than 4 inches dbh.

Loss levels on a per acre basis are currently low in most areas of moderate or high risk. However, the potential for significant loss over the decade is very high. Because of the magnitude of this potential it is advisable to initiate a long-term county wide program to bring stands into a managed status at a rate that significantly exceeds recent harvest levels on all lands. From a biological viewpoint of the mountain pine beetles' habitat, about 30 MMBF needs to be harvested annually from all lodgepole pine stands on all ownership lands within the county. Current mill capacity will handle this level of harvest if markets are available. Direct control of mountain pine beetle populations can be done in areas where the insect population is small and tree values high. To rely on direct control as the primary strategy over an extensive acreage such as Grand County would be doomed to failure. We believe that an accelerated level of management of the lodgepole type is the most efficient as well as the most effective strategy since it will regulate the amount of suitable habitat available to the beetle. This strategy will require several years of harvest activity before a significant reduction in hazard will be realized. This strategy is also strongly dependent upon developing markets for the volume of wood harvested.

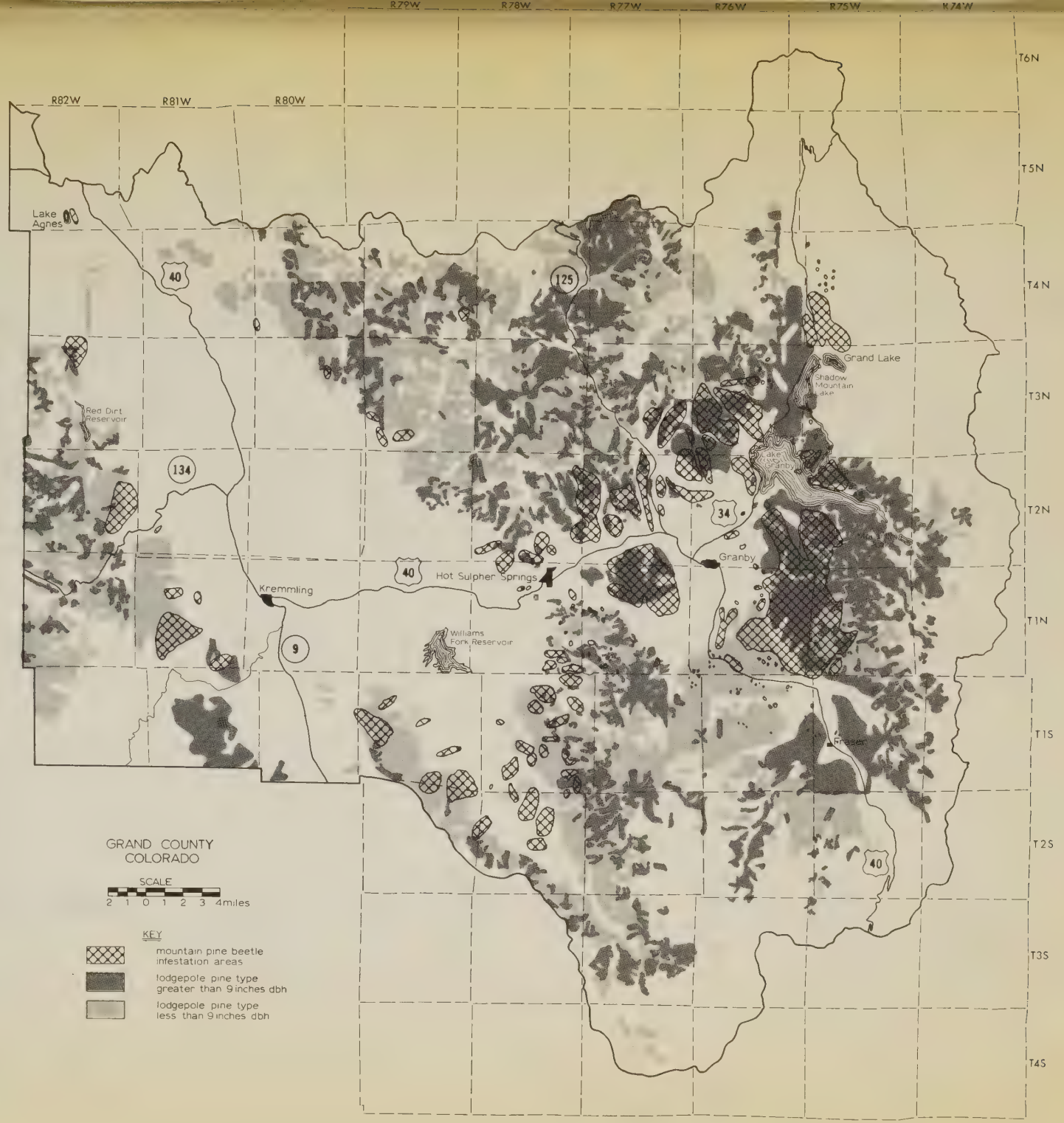

Figure 1--Distribution of lodgepole pine and mountain pine beetle in Grand County, Colorado, 1983.

TABLE 1. Lodgepole pine stand structures and present risk of priority treatment areas within Grand County Colorado for 1984.

Location	$\bar{X}$ BA of Lodgepole	$\bar{x}$ Diameter	% stands infested with dwarf mistletoe	MPB Present	MPB Risk	Total BA	No. Plots
NFS							
Red Dirt Rd. Sec. 35	85 ± 32	8.8 ± 1.6	26	No	Mod-High	101 ± 32	27
Red Dirt Rd. Sec. 26	63 ± 23	8.9 ± 1.4	0	No	Mod-High	108 ± 49	6
Ute Pass	80 ± 35	8.8 ± 2.7	41	Yes	High	98 ± 34	4
Sugarloaf CG	138 ± 38	8.3 ± 2.0	22	No	Moderate	142 ± 43	5
South Fork CG	86 ± 34	8.1 ± 0.8	46	No	Moderate	88 ± 31	5
Troublesome	78 ± 25	10.3 ± 3.1	0	Yes	High	80 ± 24	16
Tabernash CG	138 ± 65	9.0 ± 1.8	57	Yes	High	138 ± 55	6
BLM							
Dice Hill	88 ± 28	9.6 ± 2.9	38	Yes	High	100 ± 29	22
Canyon Creek	108 ± 46	9.8 ± 1.3	1	Yes	High	121 ± 43	12
State							
T. 2 N., R. 76 W., Sec. 36	118 ± 52	8.7 ± 1.6	0	Yes	High	125 ± 45	6
Private							
Winter Park H.	117 ± 41	9.9 ± 1.2	0	Yes	High	117 ± 41	6
Chenoweth Ranch	58 ± 19	10.9 ± 2.2	0	Yes	High	75 ± 24	4
ho Ranch	108 ± 26	7.9 ± 2.0	38	Yes	High	108 ± 26	50*
YMCA	123 ± 42	6.1 ± 1.5	92	No	Low	123 ± 42	13*
Stillwater Estates	88 ± 28	9.6 ± 2.9	44	No	Moderate	88 ± 28	9*

* data provided by CSFS on stand basis

ALTERNATIVES

A variety of tactics are available for reducing either the mountain pine beetle population or the effects of its activities. Some techniques are well established such as direct chemical control while others such as silvicultural treatment are not demonstrated for all stand and site conditions.

Alternative 1: Chemical Control - This involves the use of a registered insecticide such as lindane or EDB. After September 1984 only lindane will be available. Treatment involves felling the infested green tree, limbing and bucking into manageable units and the application of the insecticide.

Alternative 2: Mechanical Control - This involves felling infested trees and destroying their subbark habitat by burning, chipping, or peeling the infested log.

Alternative 3: Utilization - This involves felling of green infested and older dead trees, removing them from the site and utilizing their value as a wood product.

Alternative 4: Behavior Chemicals - This involves the use of MPB pheronones and pine terpines to attract beetles into traps or trap trees. While the concept is valid it does not perform consistently enough for us to recommend it as a tactic at this time. It appears that the best success can probably be obtained in isolated "hot spots" with close monitoring.

Alternative 5: Preventative Sprays - This alternative involves spraying the bole of high valued trees to a 5" diameter top using a registered insecticide such as carbaryl or lindane. It is effective in campgrounds, around private homes and businesses where individual tree values are high.

Alternative 6: Biological Control - This includes augumentation of parasites, predators, and disease. This has not been demonstrated to be effective on a broad scale.

Alternative 7: Silvicultural Treatment - This involves removal of green infested trees as well as additional trees from the stand to bring it into a better growing condition. The stand is treated as a unit with a prescriptive treatment that will reduce future bark beetle risk and enhance or meet other values. Prescriptions developed for Summit County by an interagnecy task force are included in Appendix B.

The alternatives are merely treatment tactics and must be viewed in the broader context of integrated pest management. An insect becomes a pest when it becomes numerous enough to damage some resource. Since resource values vary in space, time, and perception, a broader resource decision-

making analysis needs to be applied in order to determine which suppression tactic works best under which condition. This involves the consideration of the stand dynamics, the insect dynamics, the management objectives, and the impacts associated with the various suppression tactics. Benefit/cost analysis serves as the means of integrating these complex questions into the broader resource management direction.

Tree mortality caused by mountain pine beetle will continue to occur where there are suitable host tree species. The key to managing the insect/host complex is to reduce tree mortality to an acceptable level. An acceptable level of tree mortality will vary in accordance with the goals and objectives of the land manager for specific areas. Therefore, management strategies must be developed which consider a wide range of management objectives and land use values.

Freeling and Seaver (1980) utilized decision analysis to match management strategy to a land classification system. Their procedure resulted in a land classification system based on the following criteria:

1. Risk to mountain pine beetle infestation.
2. Land accessibility (and/or operability).
3. Tree value.

Values for timber, recreation, scenic quality, and real estate were transferred to a commensurable scale from -100 to 100, where negative numbers reflected costs incurred and positive numbers representated profits gained. They termed these values "single attribute utilities". These utilities were then weighted by the USDA Forset Service, Colorado Divsion of Wildlife, the Advisory Council on Off-Road Vehicle Recreation, and the Sierra Club. Dollar value ranges for each attribute varied significantly by each group queried.

These utility values were then incorporated into the land classification scheme to determine which control tactics were most favorable in each land classification scheme. Further discussion and rationale for this type of strategy is presented in Appendix A. We think the strategy warrents consideration of any large scale mountain pine beetle suppression project to assist land managers in prioritizing treatments and in verifying or revising management objectives, as well as gaining a greater understanding of the complex MPB/host system that creates the level of public attention as seen in recent years.

RECOMMENDATIONS

Land managers and owners should join together in Grand County to develop and carry out a long term coordinated management program with the following objective:

> Minimize future adverse impacts from mountain pine beetle and future wildfire hazard and maximize all resource values according to stated management goals and objectives. The program should be based on a strategy that includes a land classification and prioritization system that incorporates risk to mountain pine beetle, land accessibility, and tree value.

APPENDIX A

A Revised Strategy

Mountain pine beetle (*Dendroctonus ponderosae* Hopk.) is endemic to lodgepole pine (*Pinus contorta* Dougl.), ponderosa pine (*P. ponderosa* Laws.) and limber pine (*P. flexilis* James) in Colorado. Tree mortality caused by this insect will continue to occur where there are suitable host tree species. The key to managing the insect-host complex is to reduce tree mortality to some acceptable level. An acceptable level of tree mortality will vary in accordance with the goals and objectives of the land manager for specific land areas. Therefore, management strategies must be developed which consider a wide range of management objectives and land use values.

Using decision analysis, a procedure was developed to match management strategy to a land classification system (Freeling and Seaver, 1980). The procedure first develops a land classification system based on the following criteria:

1. Risk to mountain pine beetle (MPB) infestation
2. Land accessibility (and/or operability)
3. Tree value

The eight land classification categories developed were:

A. Moderate to high MPB risk
   Accessible
   High individual tree value

B. Moderate to high MPB risk
   Accessible
   Low individual tree value

C. Moderate to high MPB risk
   Inaccessible
   High individual tree value

D. Moderate to high MPB risk
   Inaccessible
   Low individual tree value

E. Low risk to MPB
   Accessible
   High individual tree value

F. Low risk to MPB
   Accessible
   Low individual tree value

G. Low risk to MPB
Inaccessible
High individual tree value

H. Low risk to MPB
Inaccessible
Low individual tree value.

The criteria used to develop the land classification system are qualitative. However, each can be quantified. Since this is a dynamic classification scheme, it will need to be updated to keep pace with tree growth (risk), improved harvesting technology, and changing land use values.

Mountain pine beetle risk - There are three published schemes for risk rating mountain pine beetle in lodgepole pine (Amman et al. 1977; Waring and Pitman 1980; Schenk et al 1980). To date Amman et al (1977) is the most reliable scheme to estimate stand risk to mountain pine beetle. In addition this scheme is available on computer using Stage II data.

Accessibility - Accessibility implies operability. Both accessibility and operability vary with the management strategy selected and the equipment available to implement the strategy. As an example, slopes in excess of 40% may be inoperable to conventional logging equipment but operable for a high lead system; or, operable for chemical pesticide application.

Tree Value - Value systems are highly variable and often difficult to quantify. The goals and objectives established for an area determine the value system(s) to be used (ie. recreation and aesthetics, wildlife habitat, wood fiber, etc.). Thus, a given piece of land and tree resource will have a value affected by tree density, and quality, and land use. Effects of the mountain pine beetle may enhance or detract from that value. The objective is to minimize the loss of the resource value from mountain pine beetle through the application of one or more strategies. For mountain pine beetle there are three preventative strategies:

1. Thinning of stands

2. Preventative spraying

3. Favoring tree species other than the host species

and two-broad suppression strategies:

1. Direct control-actions taken to reduce the population immediately.

2. Indirect control-actions taken to reduce habitat and minimize outbreak potential.

Inherent in these management strategies is their applicability, or more properly, their nonapplicability on some land classifications. As an example, direct chemical treatment of low risk, low value trees over large inaccessible areas would be inefficient economically and therefore inappropriate.

Five major premises were developed using decision analysis (Freeling and Seaver, 1980):

1. All host type, regardless of ownership can be stratified into land classification units.

2. Mountain pine beetle cannot be eliminated by any method over extensive areas of land.

3. Management and control of MPB is viable in restricted areas of type having relatively high value,

4. The ideal strategy for managing mountain pine beetle is to intensively manage the host type, thereby preventing outbreaks from occurring.

5. Prevention is a viable strategy only in moderate to high susceptible stands or in low susceptible stands which will be in a moderate to high susceptible condition in the near future.

Failure to recognize these premises will lead to failure for any long range management of mountain pine beetle.

Management opportunities identified in the decision analysis process (Freeling and Seaver 1980) were:

1. Incorporate into Forest plans management prescriptions for the major insects and diseases causing tree damage in the Region.

2. Involve State and local governments to a greater degree in future planning efforts.

3. In cooperation with Federal, State and local governments and private landowners implement a management program to prevent and suppress the mountain pine beetle on all lands in land classifications A, B, C, and E using the following recommended strategies.

Land Classification A - On developed recreation areas where mountain pine beetle is present, the preferred strategy is to suppress the insect by harvesting infested trees before beetle flight. On developed recreation areas where an epidemic has run its course, the preferred strategy is to do nothing. If an epidemic has not yet occurred, thinning is recommended. This reduces the susceptibility of the area to mountain pine beetle.

On type A areas other than developed recreation sites, the preferred suppression strategy is thinning for prevention, or harvesting of

infested trees. In areas where the beetle is already epidemic, the preferred strategy is dependent upon tree value and recreation values. If the recreational value is greater than about six times the stumpage value (acre basis), then suppression is best. With lower recreation values, however, thinning is the preferred strategy. In areas where the beetle is either not present, or inactive, thinning is preferred, as thinning may prevent beetle epidemics. In particular, immediate thinning is much preferred to waiting for an epidemic to start and then thin. Thorough analysis of the benefits and costs of the various tactics in relation to the value of the management objectives will aid in development of the preferred approach to suppression in a given situation.

Land Classification B - In these areas a thinning program is the preferred strategy. This is due largely to the beneficial silvicultural effects and reduced detrimental recreation effects.

Land Classification C - In these areas where thinning is impractical due to constraints on accessibility and operability, suppression by chemical means is considered the best strategy under epidemic conditions. However, this strategy is only marginally superior to doing nothing and accepting the losses.

Land Classification E - On these low MPB susceptibility areas, harvesting infested trees is the preferred strategy. Because these are high value lands, this strategy is effective in reducing the impacts on scenic, recreational and real-estate value.

In summary, the greatest benefit appears to be from thinning programs in those highly susceptible areas where beetles are not present, but there is also some net benefit from continuing with suppression efforts in those higher value areas where beetles are present.

4. On land classification areas D, F, G, and H allow the mountain pine beetle to run its course.

5. Initiate and maintain a continuous program of unified management on all lands.

APPENDIX B

The prescriptions presented here are a result of an interagency task force composed of entomologists, silviculturists, pathologists, and foresters from the CSFS and USDAFS. These prescriptions were developed in 1981 and have been applied to several locations in Summit, Colorado.

GENERAL PRESCRIPTION

The purpose of the general prescription is to describe the ecological situation in which epidemic outbreaks of mountain pine beetle are least likely to occur and to provide a guiding framework for the more specific stand prescriptions. The following objectives are included in the general prescription:

1. Establish a diverse mosaic of stand size classes, age classes, and species mixtures.

2. Design this mosaic for an aesthetically pleasing appearance and for productive wildlife habitat conditions.

3. Make a long term commitment for management to avoid stand conditions susceptible to epidemic outbreaks. This can partially be accomplished through Forest Plans.

4. Provide access needed for stand management, now and in the future.

5. Salvage felled or killed trees to the extent possible.

6. Maintain and improve visual quality through varying stand shapes and sizes, removing of visually dominant dead trees, and increasing species diversity of the vegetation.

7. Replace susceptible lodgepole pine in recreation or high use areas through planting of species appropriate to site conditions. This may include planting of lodgepole pine, other conifers, leaving created openings, or planting species beneficial to wildlife and aesthetics.

8. Develop specific long term vegetation management plans for ski areas or other high-value developed sites.

9. Prioritize stands for treatment using the risk ratings shown in "Guidelines for Reducing Losses of Lodgepole Pine to the Mountain Pine Beetle in Unmanaged Stands in the Rocky Mountains" by Amman, McGregor, Cahill and Klein, 1977, USDA Forest Service, Gen. Tech. Rpt. INT-36, Intermountain For. and Rng. Expt. Stn., Ogden, UT.

10. Insects in currently infested trees may be directly controlled using chemical, mechanical, or burning methods in combination with silvicultural methods.

11. Reduce existing and resultant highly hazardous fuel accumulations.

12. Re-examine stands for effectiveness of treatment methods within 5 years of accomplishment.

The following prescriptions were developed for stand conditions anticipated with the project area. These prescriptions are qualified by the fact that not all conditions can be anticipated and owner objectives for specific locations may preclude application of the recommended treatments. Nevertheless, the prescriptions are judged to have the best potential for containing the present outbreak of mountain pine beetle.

Figure 1

PRESCRIPTION NUMBERS FOR MAJOR CONDITIONS AND SITUATIONS ANTICIPATED IN PROJECT AREA

Stand Condition	Forest Situation		
	Undeveloped Forest*	Developed Forest*	Wilderness
Susceptible LPP (7"d.b.h.+)			
Without manageable understory	1	2	11
With manageable understory	3	4	11
At least 10% BA other species	5	6	11
Stagnated, Immature LPP	7	7	11
Immature LPP Responsive to Thinning			
(Less than 70 years old, pointed crowns, 40%+ live crown)			
Pure lodgepole	8	8	11
At least 10% BA other species	9	9	11
Other Species			
Less than 30% LPP	10	10	11

* Undeveloped forest is land where recreation and amenity values do not greatly exceed those of other resources. Developed forest is land where recreation values are very high and includes campgrounds, roadside zones, ski areas, private lands held for recreation purposes, or other developed sites.

Prescription No. 1

Susceptible Lodgepole Pine Without Understory - Undeveloped Forest

1. Cutting Methods:
   A. Clearcut stands up to 40 acres in size
   B. Patch cut within stands with cut units up to 10 acres in size

All basal area of lodgepole pine would be removed in both treatments.

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter slash
   B. Salvage for firewood

3. Regeneration Methods:
   Natural regeneration

4. TSI Methods:
   Not applicable

5. Other Treatments:
   A. Salvage any uncut areas within stands
   B. Fell unmerchantable trees infected with dwarf mistletoe

6. Constraints:
   Size of adjacent areas not clearcut should be approximately equal or larger in size to clearcut areas. Shapes will be influenced by appearance of the openings from important vantage points.

Prescription No. 2

Susceptible Lodgepole Pine Without Understory - Developed Forest

1. Cutting Methods:
   A. Patch cut within stands
   B. Shelterwood seed cut to basal area of 60 or less
   C. Thin from above removing most susceptible trees first to an approximate growing stock level of 80
   D. Thin from below to an approximate growing stock level of 80

2. Slash Disposal and Site Preparation Methods:
   A. Pile and burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regeneration Methods:
   A. Natural regeneration
   B. Plant species best suited to site

4. TSI Methods:
   Fell unmerchantable lodgepole in thinning treatments as needed to meet growing stock level objective.

5. Other Treatments:
   Preventative treatments with chemicals.

6. Constraints:
   A. Size of patch cuts to be constrained by location, appearance, and owner objectives.
   B. Partial cuts constrained by windthrow susceptibility, dwarf mistletoe infection level, owner objective, or other on-site condition.

Prescription No. 3

Susceptible Lodgepole Pine With Manageable Understory - Undeveloped Forest

1. Cutting Methods:
   A. Removal cut taking all lodgepole pine in excess of 7 inches d.b.h.
   B. Removal cut in stages, taking the most susceptible lodgepole pine in the first cut

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood

3. Regeneration Methods:
   Not applicable

4. TSI Methods:
   A. Thin understory if needed
   B. Remove mistletoe infected lodgepole in understory

5. Other Treatments:
   None

6. Constraints:
   Size and shape of opening may be constrained as in clearcutting if understory is not of sufficient size to have visual significance.

Prescription No. 4

Susceptible Lodgepole Pine with Understory - Developed Forest

1. Cutting Methods:
   A. Removal cut in stages removing the most susceptible lodgepole pine in the first cut
   B. Removal cut in one cut in patches up to 10 acres

2. Slash Disposal and Site Preparation Methods:
   A. Pile and Burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regeneration Methods:
   Not applicable

4. TSI Methods:
   A. Thin understory if needed
   B. Remove mistletoe infected lodgepole in understory

5. Other Treatments:
   Preventative spray

6. Constraints:
   Size and shape of opening in one cut removals will be determined by owner objective and visual impact.

Prescription No. 5

Susceptible Lodgepole Pine with Mixture of Other Species - Undeveloped Forest

1. Cutting Methods:
   A. Shelterwood seed cut to basal area of 60 or less, retaining mixed species for seed and shelter
   B. Improvement - salvage cut removing the most susceptible lodgepole and worst individuals of mixed species
   C. If mixed with aspen, patch cut lodgepole around the aspen. Aspen may or may not be cut depending on situation. Remove lodgepole pine from aspen patches.

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood

3. Regeneration Methods:
   Natural regeneration

4. TSI Methods:
   Weed and release felling to favor the mixed species

5. Other Treatments:
   None identified

6. Constraints:
   None identified

Prescription No. 6

Susceptible Lodgepole Pine with Mixture of Other Species - Developed Forest

1. Cutting Methods:
   A. Improvement - salvage cut removing the most susceptible lodgepole pine and worst individuals of mixed species
   B. Shelterwood seed cut to basal area of 60 or less, retaining mixed species for seed and shelter
   C. Partial or patch cut to favor aspen only outside of campgrounds or other areas with heavy foot traffic

2. Slash Disposal and Site Preparation Methods:
   A. Pile and burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regeneration methods:
   A. Natural regeneration
   B. Plant species appropriate to site conditions, favor those other than lodgepole

4. TSI Methods:
   Weed and release felling to favor the mixed species

5. Other Treatments:
   Preventative spray

6. Constraints:
   Site specific depending on location

Prescription No. 7

Stagnated Immature, Nonsusceptible - Undeveloped and Developed Forest (Judged not capable of release, generally more than 70 years old, rounded or tufted tops, less than 40% live crown, or DMR rating of 3.0 or more)

1. Cutting Methods:
   Defer treatment

2. Slash Disposal and Site Preparation Methods:
   Defer treatment

3. Regeneration Methods:
   Defer treatment

4. TSI Methods:
   Defer treatment

5. Other Treatments:
   None identified

6. Constraints:
   None identified

Prescription No. 8

Immature, Responsive Lodgepole Pine - Undeveloped and Developed Forest

1. Cutting Methods:
   A. Precommercial thinning between August and March to a growing stock level of 110 or less
   B. Defer treatment

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood
   C. Pile and burn
   D. Chipping

3. Regeneration Methods:
   Not applicable

4. TSI Methods:
   A. Thin by felling
   B. Sanitize by felling mistletoe infected lodgepole

5. Other Treatments:
   None identified

6. Constraints: Site specific, depending on location.

Prescription No. 9

Immature, Responsive Lodgepole with 10% or More Other Species - Undeveloped and Developed Forest Sites

1. Cutting Methods:
   A. Precommercial thinning between August and March to a growing stock level of 110 or less. Favor other species to the extent possible.
   B. Defer treatment

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood
   C. Pile and burn
   D. Chipping

3. Regeneration Methods:
   Not applicable

4. TSI Methods:
   Not applicable

5. Other Treatments:
   Preventative chemical spray on developed Forest sites

6. Constraints:
   None identified

Prescription No. 11

All Stand Conditions - Wilderness

Method:
Prepare a biological assessment of potential for outbreak and possible treatment alternatives.

Slash Disposal and Site Preparation Methods:
Not applicable

Regeneration Methods:
Not applicable

TSI Methods:
Not applicable

Other Treatments:
None identified pending results of biological assessment

Constraints:
Associated with Wilderness Act

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